STAT5014 Longitudinal Data Analysis

Instructor: Shu-Chin Lin
Email: scllin@ntu.edu.tw
Office hours: By appointment
Teaching Assistant: TBA

Course Description:

Longitudinal data consist of repeated measurements collected over time from the same subjects, enabling researchers to study temporal dynamics, individual heterogeneity, and within-subject correlation. Such data arise naturally in biomedical, public health, social science, and economic research. This course provides a comprehensive introduction to statistical methods for the analysis of longitudinal data. Emphasis is placed on model formulation, interpretation, and practical implementation, with attention to both marginal and subject-specific modeling approaches. Students will gain hands-on experience through real data examples and applied assignments.

Course Objectives:

To understand and apply statistical models and methodologies for analyzing longitudinal data, with an emphasis on interpretation and practical implementation.

Prerequisites:

Probability and Statistics; Linear Models.

Textbook and References:

Fitzmaurice, G. M., Laird, N. M., & Ware, J. H. (2011). Applied longitudinal analysis. John Wiley & Sons.

Assessment and Grading:

Homework assignments (20%): Problem sets and data analysis exercises
Midterm exam (40%): In-class, closed-book, written examination
Final project (40%): An applied longitudinal data analysis project using a student-selected dataset, including a written report and an oral presentation

Course Outline:

1. Introduction to longitudinal data and motivating examples
2. Linear models and covariance structures for longitudinal data
3. Estimation and statistical inference (MLE, REML)
4. Models for the mean structure
5. Models for the covariance structure
6. Linear Mixed Models (LMM)
7. Qingming Festival Break
8. Generalized linear models for longitudinal data
9. Marginal models: Generalized Estimating Equations (GEE)
10. Midterm Exam
11. Generalized Linear Mixed Models (GLMM)
12. Selected topics (missing data, generalized method of moments, multilevel data, or functional data)
13. Selected topics (missing data, generalized method of moments, multilevel data, or functional data)
14. Selected topics (missing data, generalized method of moments, multilevel data, or functional data)
15. Final project presentations
16. Final project presentations

Note: The instructor may adjust topics and pacing depending on class progress.